Claims 14 and 15 have been canceled. Claim 13 has been amended. Claims 16-18 have been added. Therefore, claims 1, 4-10, 12, 13 and 16-18 are under active consideration.

Claims 1-10, 12 and 13 stand rejected under 35 USC 103 as being unpatentable over Danko (U.S. 5,659,390) in view of Kodate (U.S. 5,748,266).

This rejection is respectfully traversed.

It is respectfully submitted that the above noted claims define an apparatus that is patentably different from Danko in view of Kodate.

Applicant has invented an apparatus and method for detecting particles on a surface of a semiconductor wafer having repetitive patterns which includes a laser for illuminating an area on the front surface with a beam of polarized light. A lens collects light scattered form the area and forms a Fourier diffraction pattern of the area illuminated. A Fourier mask blocks out light collected by the lens at locations in the Fourier diffraction pattern where the intensity is above a predetermined level indicative of background information and leaves in light at locations where the intensity is below the threshold level indicative of possible particle information. The Fourier mask includes a spatial light modulator and a polarization discriminator. A camera detects scattered light collected from the area by the lens and not blocked out by the Fourier mask. In one embodiment of the invention the spatial light modulator is optically addressable and in other embodiments of the invention the spatial light modulator is electrically addressable. The electrically addressable versions include a processor and an SLM controller.

Danko discloses an apparatus for detecting particles on the front surface of a

patterned semiconductor wafer having repetitive patterns which includes a laser for illuminating an area on the front surface at grazing angle of incidence with a beam of polarized light. A lens collects light scattered from the area and forms a Fourier diffraction pattern of the area illuminated. A Fourier mask blocks out light collected by the lens at locations in the Fourier diffraction pattern where the intensity is above a predetermined level indicative of background information and leaves in light at locations where the intensity is below the threshold level indicative of possible particle information. The Fourier mask includes an optically addressable spatial light modulator and a crossed polarizer with the Fourier diffraction pattern being used as both a read beam and a write beam for the spatial light modulator. A camera detects scattered light collected from the area by the lens and not blocked out by the Fourier mask .

Kodate describes, among other things, a liquid crystal display comprising an array substrate having pixel electrodes arranged like a matrix, an active element for each of the pixel electrodes, a storage capacitance provided at some of the pixel electrodes, and a storage capacitance line for outputting the reference potential of the storage capacitance; a facing substrate having a plurality of pillars arranged so as to face the array substrate, the pillars being formed higher than other portions of the facing substrate, the pillars together with objects formed on the array substrate that face the pillars specifying a cell gap, and a common electrode for all pixels covering at least some of the pillars, the common electrode being electrically connected to the storage capacitance line at the portions of the common electrode covering the pillars; a liquid crystal layer held between the array substrate and the facing substrate; and a

polarizing film set at least either of the top oft he facing substrate and the bottom of the array substrate.

In the Office Action, the Examiner made the comment regarding Kodate that there are art recognized advantages of liquid crystal displays over CRTs, such as being smaller (column 1, lines 17-21) and using less power (column 1, lines 23-24). The Examiner also commented that Kodate also notes that a liquid crystal display "provides a display quality equal to that of the CRT". Thus, according to the Examiner, for the art recognized advantages of using a liquid crystal display instead of a CRT while providing equal display quality, it would have been obvious to use a liquid crystal display instead of the CRT of the Danko reference.

With respect to the Danko reference, the Examiner made the comment that "Figure 4 of the reference shows a system similar to that claimed, but with a CRT (111) rather than a liquid crystal display to feed the output of the processor (109) to a spatial light modulator (50) to form the Fourier mask. It would have been obvious to replace the CRT with other known image forming and projecting means, such s the claimed liquid crystal display. Liquid crystal displays are well known in the art; the instant specification, for example, treats the liquid crystal display (61 in figure 1) as shown, requiring no more disclosure than a simple reference as a liquid crystal display; see page 12, line 10 and page 13, lines 13, 14, and 16 and gives no details as to structure or operation."

Applicant is not in agreement with the Examiner's analysis of Danko and Kodate.

While there may be advantages in some systems in using an LCD rather than a CRT, there is nevertheless no teaching, disclosure or suggestion in either Danko or

Kodate for substituting an LCD for the CRT in the Fig. 4 system in Danko. Advantages by themselves are not sufficient for making such a substitution. There must be a teaching or actual suggestion to do so.

Furthermore, replacement of the CRT in Fig. 4 in Danko does even more than noted by the Examiner. Replacing the CRT with an LCD enhances the performance of applicant's system in that it increases the ability of critically aligning the read and write beams on the SLM because the LCD offers reduced distortion and flatter field. This feature is mentioned nowhere in Danko or Kodate. Also, the system in claims 1 and 4-10 is much simpler, than the system in Fig. 4 in Danko, i.e. three lens rather than six lens, which results in less attenuation of the write and read beams (due to shorter total glass path) and lower background (i.e. less spurious reflections as a result of a fewer number of glass interfaces). None of these features are taught or suggested in Danko.

As can be appreciated, applicant's claimed system is simpler than the system in Fig. 4 in Danko. That is, there are fewer elements to align and maintain in alignment. Furthermore, there is increased flexibility in changing magnification with the single lens configuration in the claimed system. In applicant's claimed system there is defect imaging with a single lens and write beam imaging with a single lens, whereas in Fig. 4 in Danko there are multiple lens in each case. Also, changing the write beam magnification in the claimed system just involves a change in the conjugate distance of one lens whereas in Fig. 4 in Danko it involves a physical replacement of one or both of lens 95 and 113.

Finally, the claimed system is a more compact and rugged design in that there (1) are fewer lens to package, (2) the system is smaller and lower in weight and (3) the system uses a polarization cube beam splitter rather than a plate beam splitter plus a cross polarizer.

In summation, applicant's claimed system as defined in claims 1 and 4-10 is structurally and patentably different from the system in Fig. 4 in Danko for at least the following reasons: (1) it has an LCD rather than a CRT, (2) it has a polarizing cube beam splitter rather than a plate beam splitter and a cross polarizer and (3) it has three lens rather than six lens.

Regarding claim 12, there is simply no basis other than applicant's own disclosure for changing the system in Fig. 4 in Danko by: (1) replacing the optically addressable SLM operating in a reflective mode with an electrically addressable SLM operating in a transmissive mode, (2) replacing the CRT with an SLM controller and (3) eliminating at least two of the lens.

Regarding claim 13, there is simply no basis other than applicant's own disclosure for changing the system in Fig. 4 in Danko by: (1) replacing the optically addressable SLM operating in a reflective mode with an electrically addressable SLM operating in a reflective mode, (2) replacing the CRT with an SLM controller and (3) eliminating at least two of the lens.

Allowance of the application with claims 1, 4-10, 12, 13 and 15-18 is earnestly solicited.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop Fee Amendment, Commissioner for Patents, p.O. Box 1450, Alexandria, VA 22313-1450 on May 30, 2003.

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MARKED-UP VERSION OF THE PARAGRAPH BRIDGING PAGES 18 AND 19 IN THE SPECIFICATION

Apparatus 92 includes a light source 93, a first imaging lens 94, a beamsplitter 95, a first camera 97, a second camera 99, a processor 101, an SLM controller 103, and a Fourier mask 105 comprising an electrically addressable SLM 107 arranged for operation in a reflective mode and a crossed polarizer 109. Apparatus [91] 92 also includes a holder 15 for holding water 13. Holder 15 is mounted on a stage 17 which is movable

in two mutually perpendicular directions by a pair of motors 19 and 20, the particular details of the mechanical arrangement for moving stage 17 not being a part of this invention.

MARKED-UP VERSION OF THE THIRD FULL PARAGRAPH
IN PAGE 19 OF THE SPECIFICATION

In the operation of apparatus 92, light from source [92] 93 strikes surface 12 of wafer 13 at an angle of incidence α which is preferably between 0 and 45 degrees.

MARKED-UP VERSION OF THE FOURTH FULL PARAGRAPH IN PAGE 19 OF THE SPECIFICATION

Light scattered upward from the area illuminated is collected by first imaging lens 94 and strikes beamsplitter 95 where it is split into a transmitted beam 95-1 and a reflected beam 95-2. A Fourier transformation of the light collected by first imaging lens 94 using light from the reflected beam 95-2 is formed is formed at second camera 99. At the same time, light collected by first lens [93] <u>94</u> that is transmitted through beamsplitter strikes SLM 107 whose liquid crystal is in the back focal plane of lens 93.

MARKED-UP VERSION OF THE FOURTH FULL PARAGRAPH
IN PAGE 20 OF THE SPECIFICATION

Apparatus 121 also includes a programmable Fourier mask 141, having an electrically addressable SLM 143 identical to SLM 91 and a crossed polarizer 145, a sixth lens 147, a seventh lens 149, a second camera 151, a third camera 153, a processor 155 and an SLM controller 157. Camera [83] 85, 151 and 153 may be CCD cameras.

MARKED-UP VERSION OF THE PARAGRAPH BRIDGING PAGES 20 AND 21 OF THE SPECIFICATION

Lens 147 in combination with lens 131 images the Fourier diffraction pattern formed in Fourier plane 159 of lens 129 into camera 151 where the image is converted into a stream of digital electrical signals. The stream of digital electrical signals are processed in processor 155, as maybe desired. The processing may include raising the overall gain and/or magnitude of the image and/or blocking out selected areas and/or making the offset of the two images zero. The output of processor 155 is fed into controller 157. The output of controller 157 is fed into SLM 143. At the same time, lens 131 in combination with lens 133 images the Fourier diffraction pattern formed at Fourier plane 159 onto the liquid crystal in SLM 143. Lens 129 in combination with lens 131 forms an image of the area illuminated by light source 123 at image plane 124. The image formed at image plane 124 is then collected by lens 133 is passed through Fourier mask 141. The filtered image is then transmitted through beamsplitter 139 and then brought to focus at first camera [125] 85. The refraction pattern at Fourier plane 159 is imaged by lenses 149, 131 and 133 onto camera 153 so that the alignment of the two images on SLM 143 can be viewed.

MARKED-UP VERSION OF THE LAST PARAGRAPH ON PAGE 22 OF THE SPECIFICATION

The embodiments of the present invention recited herein are intended to be merely exemplary and those skilled in the art will be able to make numerous variations and modifications to it without departing from the spirit of the present invention. For example, an array of photodiodes can be used in place of any or each one of the cameras. Also, if the laser beam is S polarized rather than P polarized, the polarization sensitive optics would have to be adjusted accordingly. Also, the laser beams could be oriented at an angle α greater than 45 degrees if desired, even as high as 90 degrees, in which case the detection would be in [dark] <u>bright</u> field. All such variations and modifications are intended to be within the scope of the present invention as defined by the claims appended hereto.

MARKED-UP VERSION OF CLAIM 13

13. (Amended) Apparatus for detecting particles on a surface of a semiconductor wafer, said surface having repetitive patterns, the apparatus comprising:

[a.] (a) a laser for illuminating an area on said surface with a beam of plane polarized light,

[b.] (b) a first camera,

[c.] (c) a first imaging lens for collecting light scattered from the area, said first lens forming in its back local plane a Fourier transformation of the image in the Fourier plane of the first lens,

[d.] (d) a second camera for receiving an image of the Fourier transformation and producing a stream of [digitally] digital electrical signals of the image received,

[e.] (e) a processor for processing the electrical image produced by the second camera,

[f.] (f) a Fourier mask disposed in front of the first camera, the Fourier mask including an electrically addressable SLM operating in a reflective mode and a crossed polarizer, and

[g.] (g) a controller for receiving information from the processor and applying voltage signals to the SLM in response to such information received from the processor,

[h.] (h) said first camera receiving an image of the area illuminated by the first imaging lens and not blocked by the Fourier mask.